



CSI RD&D PROGRAM

Grid Integration

Grantee:

General Electric International-Energy Consulting

Partners:

Pacific Gas & Electric

CSI RD&D Funding:

\$629,102

Match Funding:

\$1,393,646

Project Timeframe:

2012-2015

RD&D Project Portal:

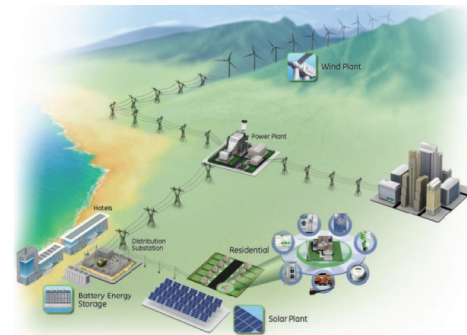
calsolarresearch.ca.gov/csi/86

Quantifying Unintended Islanding Risks and Interconnection Requirements for High Penetration Photovoltaics

OVERVIEW AND OBJECTIVES

Pacific Gas and Electric (PG&E) leads the nation in quantity and capacity of distributed generation interconnections and receives at least 2,000 interconnection applications per month. All utilities review these interconnection requirements to ensure that proper grid operations are maintained. One area of concern to utilities is islanding, a condition where distributed generation is on and connected to the load, while electrical grid power from the utility is no longer present, such as in a blackout. This condition is a safety risk to the public and utility crews.

General Electric (GE), in collaboration with PG&E, conducted research

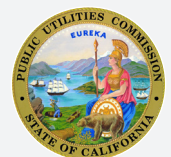


to quantify the risks of unintended islanding in distribution circuits with high penetration of customer-sited distributed PV generation. The GE and PG&E team used full-scale laboratory testing to determine the risks to both utility and customer equipment that may result

from an unintended islanding situation. The main goal of the project was to better understand the behavior of PV inverters and connected loads during an islanding event. Additionally, the team reviewed PG&E's islanding-specific interconnection requirements and provided specific recommendations on potential changes based on the findings from this project. The results of this research informed PG&E's interconnection requirements and have been valuable to other investor-and-customer-owned utilities. This research has also been useful to the CPUC in making decisions regarding interconnection requirements for anti-islanding operations of PV inverters (Rule 21).

This document provides a brief project description. For more detail on the project and the California Solar Initiative's (CSI) Research Development, Demonstration & Deployment (RD&D) Program, please visit calsolarresearch.ca.gov

The CSI RD&D Program is managed by Itron on behalf of the California Public Utilities Commission (CPUC).



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METHODOLOGY

The GE team quantified field conditions including spatial correlations and temporal matching of load types and PV. An experiment was designed and conducted to quantify the probability of islanding if a feeder or portion of a feeder is tripped. Comprehensive full-scale laboratory testing was used to determine how long an island will persist in an energized state and the risks to utility and customer equipment that may result from an unintended islanding situation. The team reviewed and suggested changes to PG&E's islanding interconnection requirements. The GE team worked with both PG&E internal technical staff and other interested stakeholders to disseminate the research findings.



Residential PV inverters installed at PG&E Applied Technology Services Center in San Ramon, CA.

RESULTS AND OUTCOMES

The recommendations to PG&E on changes to their interconnection requirements for high penetration customer-sited PV were the most significant outcome of this research. All of the recommendations from this research were shared with the utility industry, but most importantly have been implemented by PG&E.

This research project also resulted in numerous technical achievements that include:

- Building the most sophisticated MW-scale load model in the utility industry.
- Developing a highly-streamlined testing procedure that enabled capture of a large number of islanding experiments.
- Capturing and publishing an exhaustive library of islanding experiments with consistently-recorded results in high resolution.
- Developing a set of computationally efficient analysis tools and placing them in public domain.



10 MW-scale electronic load at PG&E Applied Technology Services Center in San Ramon, CA.

PUBLIC BENEFITS

Provides a research foundation and a comprehensive understanding of the conditions necessary for unintentional islanding to occur, along with the associated risk and magnitude of the problem.

Project results aid all three phases of the interconnection review process and enable more informed, circuit-specific interconnection review and study with minimal additions to the timeline.

Utilities in California can integrate higher levels of behind-the-meter PV, resulting in lower electricity demand across the system and lower energy prices for all rate-payers.